

Permit with introductory note

The Environmental Permitting (England & Wales) Regulations 2016

Valero Energy Ltd

Pembroke Refinery
Pembroke
Pembrokeshire
SA71 5SJ

Permit number
EPR/YP3930EX

Pembroke Refinery

Permit number EPR/YP3930EX

Introductory note

This introductory note does not form a part of the permit

The main features of the installation are as follows.

Location: The site is located on the south shore of the Milford Haven estuary approximately 7 km west of Pembroke, Pembrokeshire. The site is centred at NGR 190800 203000. The installation extends to around 500 acres. A natural north-south watershed divides the application site into two areas, one draining into Angle Bay to the west and the other into Martin's Haven to the East. Milford Haven estuary has been designated a Special Area of Conservation.

Operator: The site is a single-operator installation operated by Valero Energy Limited

Key activities: The purpose of the site is to process crude oil into its component parts to produce fuels for sale into various markets. The processing of crude oil involves a series of inter-linked processes, as follows:

- *De-salter:* this unit removes water and water-soluble salts from the crude oil prior to it being transferred to the crude distillation unit (CDU). The crude is water washed and additives are used to break any oil/water emulsion that could potentially form. The separation of the oil and water phases is carried out by means of an electrical field. This ensures that the maximum amount of water and salts are removed from the crude oil. The salt water is then sent to the site's effluent treatment plant. The water used within the desalter is often recirculated process water from other parts of the site.
- *Crude distillation unit (CDU):* The CDU functions to separate crude oil by distillation into the generic fractions of naphtha, kerosene, light diesel, heavy diesel, LPG and fuel gas. The unit comprises several separate distillation columns. There are a series of heat exchangers within the unit which enables heat energy to be recycled e.g. heat energy released by condensing distillates is used to pre-heat incoming crude oil stream. Around 45% of the crude oil feed to the CDU remains un-distilled and this bottom product passes on to the vacuum distillation unit (VDU) for further processing. A significant amount of sour water is produced within the CDU (via stripping steam operations). Sour water is high in impurities such as H_2S and NH_3 . The sour water is stripped with steam to remove these impurities. The H_2S and NH_3 removed are burnt in the crude charge heater.
- *Vacuum distillation unit (VDU):* The main purpose of the VDU is to re-distil the bottom product from the CDU into suitable feedstock for the Fluidised Catalytic Cracking Unit (FCCU). The distillation is carried out under partial vacuum conditions. Three overhead products are produced - diesel product, light vac gas oil, heavy vac gas oil leaving a heavy bottom product referred to as vac residue. The vacuum gas oils are passed to the FCCU and the diesel product is passed to the hydrotreater while the vac residue passes to the visbreaker unit for further processing. The VDU has an associated Sour water stripper unit which removes from sour gas from the VDU water effluent stream. The sour gas removed is used as fuel within the VDU.

- *Visbreaker unit (VBU):* The VBU uses a process of thermal cracking to break down the complex compounds which make up the heavy feed of vacuum residue into lighter oil in the diesel range, products in the LPG and naphtha ranges and a heavy residual oil. This residual oil is blended with similar oils from other process units to produce a fuel oil suitable for industrial processes. This fuel is also used as refinery fuel oil (RFO). The diesel produced on the VBU is sent to one of the hydrotreaters, the naphtha is sent to the Unifiner, the LPG is sent to one of the Merox units and any gas produced is added to the refinery fuel gas (RFG) system.
- *Hydrotreaters:* There are 2 hydrotreaters on site. Both units reduce the sulphur content of diesel by passing the diesel through a catalyst bed in the presence of hydrogen. The sulphur is removed as H_2S which is then absorbed into a solution of diethanolamine which will be processed within the amine and sulphur recovery units.
- *Unifiner:* The Unifiner unit removes any impurities such as metals, sulphur, nitrogen and water from naphtha before feeding the heavier fractions to the platformer unit. The process occurs in the presence of excess hydrogen over a nickel-molybdenum catalyst and produces hydrogen, LPG and a naphtha stream. The naphtha is subsequently separated into light and heavy naphtha fractions. Hydrogen is sent to the hydrotreater, LPG is sent to the CDU, the light naphtha is sent to the isomerisation unit while the heavy naphtha is sent to the Platformer unit.
- *Merox units:* The Merox unit converts the mercaptans in kerosene to disulphides. This reduces the odour and corrosive nature of the kerosene.
- *Platformer unit:* The Platformer unit comprises the Catalytic Reformer unit (CRU) and the Continuous Catalytic Regeneration Unit (CCR). The CRU comprises a 3-stage high temperature process using a platinum catalyst which produces aromatic hydrocarbons from paraffin's and naphthalene's in heavy naphtha which has been hydrotreated in the Unifiner to remove sulphur, nitrogen and unsaturated compounds. This conversion produces a high-octane stream known as platformate while benzene, LPG and hydrogen are produced as by-products. The platinum catalyst is continuously regenerated in the directly linked CCR.
- *Hydrogen Recovery Unit (HRU):* This unit uses pressure swing absorption to recover hydrogen from RFG.
- *Isomerisation unit (ISOM):* The ISOM unit converts C5 and C6 straight chain hydrocarbons into their isomers in the presence of hydrogen and a platinum catalyst. The catalyst is activated by means of a chlorocarbon and thus the off-gases are acidic. These are neutralised in a caustic scrubber before they are sent to the LPGRU. The isomerised hydrocarbon is used in gasoline blending.
- *Fluid Catalytic Cracking Unit (FCCU):* The FCCU unit breaks down the heavy complex and long chain hydrocarbons from the CDU and VDU to produce lighter oils and gases that can be used as LPG or gasoline for blending. The main feedstock is vacuum gas oil although this may be supplemented by higher fractions from the CRU or VDU bottoms. The unit has a 3-stage cyclone system to abate emissions of particulate (catalyst) to air. The catalyst is thermally treated to remove any hydrocarbon/carbon deposited on its surface during the process before being recycled to the cracking unit.

- *Ultra-low sulphur gasoline unit (ULSG):* The ULSG reduces the sulphur content of naphtha streams from the FCCU. Naphtha feeds are processed in 2 catalytic distillation columns and a fixed catalyst bed along with hydrogen to form ultra-low sulphur naphtha and H₂S. The ultra-low sulphur naphtha is routed to storage through a caustic prewash and the naphtha Merox unit. H₂S is absorbed into the amine stream and transported back to the amine recovery unit for processing.
- *Alkylation unit:* This unit combines short-chain alkenes from the FCCU with iso-butane from the Butamer unit to form C7 and C8 branched hydrocarbons known as alkylate. The reaction is catalysed by Hydrofluoric acid.
- *Butamer unit:* The Butamer unit is used to increase the iso-butane content of the butane stream feedstock for the alkylation unit. The reaction section is a fixed bed catalytic process for the conversion of n-Butane to iso-Butane.
- *Amine recovery and sulphur recovery units (ARU and SRU):* The ARU and SRU work in combination to convert acid gas (H₂S/SO₂) from refinery gas streams into elemental sulphur which is sold as a feedstock into the chemical industry. Acid gas from the various refinery processes is absorbed into diethanolamine at source. The diethanolamine is then transferred to the ARU where the acid gas is removed under vacuum. The acid gas is then transferred to the SRU where the acid gas is converted to elemental sulphur in the presence of an alumina catalyst and steam in a 3-stage Claus convertor and Superclaus (as per IC24 in original IPPC permit QP3033LW).
- *Waste water treatment facility (WWTP):* All process water, surface water and ballast water at the site is treated in the on-site WWTP. The WWTP consists of equalisation basins to ensure that the feed to the WWTP is consistent, API to remove oil and suspended solids from the feed, DAF unit to further remove oil and suspended solids and a biological treatment plant. After treatment, the water is discharged into the Milford Haven waterway.
- *Cogeneration Plant:* The cogeneration plant will produce up to 49.9 megawatts of electrical output (MWe) from the combustion of natural gas in a combustion turbine generator (CTG) to provide electricity to the refinery. Superheated steam will be generated via a heat recovery steam generator (HRSG) and will supplement the refineries steam demand. The plant will be connected to the refinery's steam infrastructure as well as the natural gas and electrical distribution systems. There is a de-mineralisation plant associated with the cogeneration plant to provide a flow of softened and filtered water to allow on-line and off-line washing of the CTG. Neutralised regeneration fluid from the unit to the existing waste water drain line.

The schedules specify the changes made to the permit.

The status log of a permit sets out the permitting history, including any changes to the permit reference number.

Status log of the permit		
Detail	Date	Comments
Application QP3033LW	Duly made 21/09/2006	
Additional Information Received Certificate of Incorporation Details on combustion units	18/08/06 24/01/07	Confirmation of site boundary.

Status log of the permit

Detail	Date	Comments
Site plan	24/02/07	
Response to Schedule 4 notice issued 08/12/06	02/02/07	
	09/02/07	
	20/03/07	
	12/04/07	
Response to Schedule 4 notice issued 02/04/07	01/05/07	
Response to Schedule 4 notice issue 02/05/07	25/05/07	
Response to Schedule 4 notice issued 04/01/07	15/06/07	
Historical data on emission to water	19/06/07	
Annual VOC emissions	16/07/07	
Historical data on emissions to air	16/07/07	
Historical data on carbon monoxide releases to air	17/09/07	
Sulphur dioxide emissions from sulphur recovery unit	21/09/07	
	25/09/07	
Letter justifying request for higher annual mass limit	04/10/07	
e-mail detailing methods used for monitoring emissions to water	15/10/07	
	16/10/07	
e-mail detailing SO2 releases from SRU and % efficiency	17/10/07	
	01/11/07	
e-mail detailing effluent temperature		
e-mail on volumetric flows of A9/A10 flue		
e-mail on H2S concentration in Refinery fuel gas		
Permit determined	20/12/2007	Permit issued
Variation application ERR/QP3033LW/V002	Duly made 13/08/10	
Variation issued ERR/QP3033LW/V002	11/09/10	
Notified of change of company name and registered office address	26/08/11	
Variation issued EPR/QP3033LW/V003	21/09/11	
Variation application EPR/QP3033LW/V004	06/01/12	
Variation issued EPR/QP3033LW/V004	05/04/12	
Variation determined EPR/QP3033LW/V005	26/03/13	
Transfer application EPR/YP3930EX/T001 (full transfer of permit EPR/QP3033LW)	Duly made 18/09/13	
Transfer determined EPR/YP3930EX	01/01/14	Permit transferred to Valero Energy Limited company No 8566216 as of 01/01/14, from Valero Energy Limited company No 145197
Regulation 60 Notice sent to the Operator	08/10/15	Issue of a Notice under Regulation 60(1) of the EPR. Natural Resources Wales

Status log of the permit		
Detail	Date	Comments
		initiated review and variation to vary the permit.
Regulation 60 Notice response	06/11/15	Response received from the Operator.
Job Aid – PP-HES-JBA-0004	15/12/15	Supporting documentation
Regulation 60 Notice response	06/11/15	Response received from the Operator.
Variation determined EPR/YP3930EX/V002	23/12/15	Varied permit issued.
Variation determined EPR/YP3930EX/V003	09/12/16	NRW led variation to add hazardous waste storage to the permit.
Variation EPR/YP3930EX/V004	03/03/17	Administrative variation to change registered address.
Variation EPR/YP3930EX/V005	Duly Made 31/05/17	
Schedule 5 notice issued	05/06/17	Notice issued requesting additional information relating to the noise assessment
Additional Information Received	19/06/17	Additional information relating to the noise assessment
Additional Information Received	12/07/17	Additional Information relating to the noise assessment
Additional Information Received	20/07/17	Additional Information relating to the noise assessment
Schedule 5 notice issued	02/08/17	Notice issued requesting additional information relating to the noise assessment
Additional Information Received	08/08/17	Additional information relating to the noise assessment
Variation determined EPR/YP3930EX/V005	20/10/17	Consolidated and varied permit issued.
Permit Review Issued EPR/YP3930EX/V006	11/07/18	Reviewed against Refinery BREF Note. Consolidated permit issued.
Variation Application EPR/YP3930EX/V007	Duly Made 30/09/20	Minor technical variation for a trial.
Variation determined EPR/YP3930EX/V007	06/11/20	

Other Part A installation permits relating to this installation		
Operator	Permit number	Date of issue
Valero Energy Ltd	Waste Management licence EPR/YB3997TZ/T001	01/01/2014

End of introductory note

Permit

The Environmental Permitting (England and Wales) Regulations 2016

The Natural Resources Body for Wales (“Natural Resources Wales”) authorises, under regulation 13 of the Environmental Permitting (England and Wales) Regulations 2016

Permit number

EPR/YP3930EX

issued to

Valero Energy Ltd

whose registered office is

Fifth Floor

100 Wood Street

London

EC2V 7EX

company registration number **8566216**

to operate a regulated facility at

Pembroke Refinery

Pembroke

Pembrokeshire

SA71 5SJ

to the extent authorised by and subject to the conditions of this permit.

Signed	Date
Holly Noble	06/11/2020

Authorised on behalf of Natural Resources Wales

Conditions

1 Management

1.1 General management

- 1.1.1 The operator shall manage and operate the activities:
- (a) in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and
 - (b) using sufficient competent persons and resources.
- 1.1.2 Records demonstrating compliance with condition 1.1.1 shall be maintained.
- 1.1.3 Any person having duties that are or may be affected by the matters set out in this permit shall have convenient access to a copy of it kept at or near the place where those duties are carried out.

1.2 Energy efficiency

- 1.2.1 The operator shall:
- (a) take appropriate measures to ensure that energy is used efficiently in the activities;
 - (b) review and record at least every four years whether there are suitable opportunities to improve the energy efficiency of the activities; and
 - (c) take any further appropriate measures identified by a review.

1.3 Efficient use of raw materials

- 1.3.1 For the following activities referenced in schedule 1, table S1.1 (A1 to A18.) The operator shall:
- (a) take appropriate measures to ensure that raw materials and water are used efficiently in the activities;
 - (b) maintain records of raw materials and water used in the activities;
 - (c) review and record at least every four years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use; and
 - (d) take any further appropriate measures identified by a review.

1.4 Avoidance, recovery and disposal of wastes produced by the activities

- 1.4.1 The operator shall take appropriate measures to ensure that:
- (a) the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste by the activities; and

- (b) any waste generated by the activities is treated in accordance with the waste hierarchy referred to in Article 4 of the Waste Framework Directive; and
 - (c) where disposal is necessary, this is undertaken in a manner which minimises its impact on the environment.
- 1.4.2 The operator shall review and record at least every four years whether changes to those measures should be made and take any further appropriate measures identified by a review.

2 Operations

2.1 Permitted activities

- 2.1.1 The operator is only authorised to carry out the activities specified in schedule 1 table S1.1 (the “activities”).

2.2 The site

- 2.2.1 The activities shall not extend beyond the site, being the land shown edged in green on the site plan at schedule 7 to this permit.

2.3 Operating techniques

- 2.3.1
 - (a) For the following activities referenced in schedule 1, table S1.1 (A1 to A18.) The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in schedule 1, table S1.2, unless otherwise agreed in writing by Natural Resources Wales.
 - (b) If notified by Natural Resources Wales that the activities are giving rise to pollution, the operator shall submit to Natural Resources Wales for approval within the period specified, a revision of any plan or other documentation (“plan”) specified in schedule 1, table S1.2 or otherwise required under this permit which identifies and minimises the risks of pollution relevant to that plan, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.
- 2.3.2 Any raw materials or fuels listed in schedule 2 table S2.1 shall conform to the specifications set out in that table.
- 2.3.3 Waste shall only be accepted if:
 - (a) it is of a type and quantity listed in schedule 2 table(s) S2.1(a) and S2.1(b); and
 - (b) it conforms to the description in the documentation supplied by the producer and holder.
- 2.3.4 The operator shall ensure that where waste produced by the activities is sent to a relevant waste operation, that operation is provided with the following information, prior to the receipt of the waste:
 - (a) the nature of the process producing the waste;
 - (b) the composition of the waste;

- (c) the handling requirements of the waste;
 - (d) the hazardous property associated with the waste, if applicable; and
 - (e) the waste code of the waste.
- 2.3.5 The operator shall ensure that where waste produced by the activities is sent to a landfill site, it meets the waste acceptance criteria for that landfill.
- 2.3.6 For the following activities: LCP371, LCP372, LCP373, LCP374, LCP375 and LCP652, the end of the start-up period and the start of the shutdown period shall conform to the specifications set out in the Job Aid-PP-HES-JBA-0004.
- 2.3.7 For the following activities: LCP371, LCP372, LCP373, LCP374, LCP375 and LCP652, the following conditions apply where there is a malfunction or breakdown of any abatement equipment:
- Unless otherwise agreed in writing by Natural Resources Wales:
- a) If a return to normal operations is not achieved within 24 hours, the operator shall reduce or close operations, or shall operate the activities using low polluting fuels;
 - b) The cumulative duration of breakdown in any 12-month period shall not exceed 120 hours; and
 - c) The cumulative duration of malfunction in any 12-month period shall not exceed 120 hours.

2.4 Improvement programme

- 2.4.1 The operator shall complete the improvements specified in schedule 1 table S1.3 by the date specified in that table unless otherwise agreed in writing by Natural Resources Wales.
- 2.4.2 Except in the case of an improvement which consists only of a submission to Natural Resources Wales, the operator shall notify Natural Resources Wales within 14 days of completion of each improvement.

2.5 Pre-operational conditions

- 2.5.1 The operations specified in Schedule 1 table S1.4 shall not commence until the measures specified in that table have been completed.

3 Emissions and monitoring

3.1 Emissions to water, air or land

- 3.1.1 There shall be no point source emissions to water, air or land except from the sources and emission points listed in schedule 3 tables S3.1(a), S3.1(b), S3.1(c) and S3.2;
- 3.1.2 The limits given in schedule 3 shall not be exceeded.
- 3.1.3 For the following activities referenced in schedule 1, table S1.1 (A1 to A18) where a substance is specified in schedule 3 table S3.2 but no limit is set for it, the concentration of such substance in emissions to water from the relevant emission point shall be no greater than the background concentration.

- 3.1.4 Periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination.
- 3.1.5 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 3 tables S3.1(a), S3.1(b), S3.1(c) and S3.2 unless otherwise specified in that schedule.
- 3.1.6 The operator shall, unless otherwise agreed in writing by Natural Resources Wales, undertake the monitoring specified in the following tables in schedule 4 to this permit:
 - (a) point source emissions specified in tables S3.1(a), S3.1(b), S3.1(c) and S3.2

3.2 Emissions of substances not controlled by emission limits

- 3.2.1 Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions.
- 3.2.2 The operator shall:
 - (a) if notified by Natural Resources Wales that the activities are giving rise to pollution, submit to Natural Resources Wales for approval within the period specified, an emissions management plan which identifies and minimises the risks of pollution from emissions of substances not controlled by emission limits;
 - (b) implement the approved emissions management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.
- 3.2.3 All liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container.

3.3 Odour

- 3.3.1 Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable to minimise the odour.
- 3.3.2 The operator shall:
 - (a) if notified by Natural Resources Wales that the activities are giving rise to pollution outside the site due to odour, submit to Natural Resources Wales for approval within the period specified, an odour management plan which identifies and minimises the risks of pollution from odour;
 - (b) implement the approved odour management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.

3.4 Noise and vibration

- 3.4.1 Emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved noise and vibration management plan to prevent or where that is not practicable to minimise the noise and vibration.
- 3.4.2 The operator shall:
- (a) if notified by Natural Resources Wales that the activities are giving rise to pollution outside the site due to noise and vibration, submit to Natural Resources Wales for approval within the period specified, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration;
 - (b) implement the approved noise and vibration management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.

3.5 Monitoring

- 3.5.1 The operator shall, unless otherwise agreed in writing by Natural Resources Wales, undertake the monitoring specified in the following tables in schedule 3 to this permit:
- (a) point source emissions specified in tables S3.1(a), S3.1(b), S3.1(c)
 - (b) surface water specified in table S3.2;
- 3.5.2 The operator shall maintain records of all monitoring required by this permit including records of the taking and analysis of samples, instrument measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made based on such data.
- 3.5.3 Monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring programme and the environmental or other monitoring specified in condition 3.5.1 shall have either MCERTS certification or MCERTS accreditation (as appropriate) unless otherwise agreed in writing by Natural Resources Wales.
- 3.5.4 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 3 tables S3.1(a), S3.1(b), S3.1(c), and S3.2 unless otherwise agreed in writing by Natural Resources Wales.

3.6 Monitoring for the purposes of the Industrial Emissions Directive

- 3.6.1 All LCP monitoring required by this permit shall be carried out in accordance with the provisions of Annex V of the Industrial Emissions Directive.
- 3.6.2 If the monitoring results for more than 10 days a year are invalidated within the meaning set out in schedule 3, the Operator shall:
- a) within 28 days of becoming aware of this fact, review the causes of the invalidations and submit to Natural Resources Wales for approval, proposals for measures to improve the reliability of the continuous measurement systems, including a timetable for the implementation of those measures; and
 - b) implement the approved measures.

- 3.6.3 Continuous measurement systems on emission points from the LCP shall be subject to quality control by means of parallel measurements with reference methods at least once every calendar year.
- 3.6.4 Unless otherwise agreed in writing by Natural Resources Wales in accordance with condition 3.6.5 below, the operator shall carry out the methods, including the reference measurement methods, to use and calibrate continuous measurement systems in accordance with the appropriate CEN standards.
- 3.6.5 If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall be used, as agreed in writing with Natural Resources Wales.
- 3.6.6 Where required by a condition of this permit to check the measurement equipment the operator shall submit a report to Natural Resources Wales in writing, within 28 days of the completion of the check.
- 3.6.7 Where Continuous Emission Monitors are installed to comply with the monitoring requirements in Schedule3 tables S3.1(a), S3.1(b), S3.1(c); the Continuous Emissions Monitors shall be used such that:
- a) for the continuous measurement systems fitted to the LCP release points defined in tables S3.1(a), S3.1(b), S3.1(c), the validated hourly, monthly and daily averages shall be determined from the measured valid hourly average values after having subtracted the value of 95% confidence interval;
 - b) the 95% confidence interval for Nitrogen Oxides and Sulphur Dioxide of a single measured result shall be taken to be 20%;
 - c) the 95% confidence interval for dust releases of a single measured result shall be taken to be 30%;
 - d) the 95% confidence interval for Carbon Monoxide releases of a single measured result shall be taken to be 10%;
 - e) any invalid hourly average means an hourly average period invalidated due to malfunction of, or maintenance work being carried out on, the continuous measurement system. However, to allow some discretion for zero and span gas checking, or cleaning (by flushing), an hourly average period will count as valid as long as such data has been accumulated for at least two thirds of the period (40 minutes). Such discretionary periods are not to exceed more than 5 in any one 24-hour period unless agreed in writing. Where plant may be operating for less than the 24-hour period, such discretionary periods are not to exceed more than one quarter of the overall valid hourly average periods unless agreed in writing; and
 - f) any day, which more than three hourly average values are invalid shall be invalidated.

4 Information

4.1 Records

4.1.1 All records required to be made by this permit shall:

- (a) be legible;
- (b) be made as soon as reasonably practicable;
- (c) if amended, be amended in such a way that the original and any subsequent amendments remain legible, or are capable of retrieval; and
- (d) be retained, unless otherwise agreed in writing by Natural Resources Wales, for at least 6 years from the date when the records were made, or in the case of the following records until permit surrender:
 - (i) off-site environmental effects; and
 - (ii) matters which affect the condition of the land and groundwater.

4.1.2 The operator shall keep on site all records, plans and the management system required to be maintained by this permit, unless otherwise agreed in writing by Natural Resources Wales.

4.2 Reporting

4.2.1 The operator shall send all reports and notifications required by the permit to Natural Resources Wales using the contact details supplied in writing by Natural Resources Wales.

4.2.2 A report or reports on the performance of the activities over the previous year shall be submitted to Natural Resources Wales by 31 January (or other date agreed in writing by Natural Resources Wales) each year. The report(s) shall include as a minimum:

- (a) a review of the results of the monitoring and assessment carried out in accordance with the permit including an interpretive review of that data;
- (b) the annual production /treatment data set out in schedule 4 table S4.2; and
- (c) the performance parameters set out in schedule 4 table S4.3 using the forms specified in table S4.4 of that schedule.

4.2.3 Within 28 days of the end of the reporting period the operator shall, unless otherwise agreed in writing by Natural Resources Wales, submit reports of the monitoring and assessment carried out in accordance with the conditions of this permit, as follows:

- (a) in respect of the parameters and emission points specified in schedule 4 table S4.1;
- (b) for the reporting periods specified in schedule 4 table S4.1 and using the forms specified in schedule 4 table S4.4; and
- (c) giving the information from such results and assessments as may be required by the forms specified in those tables.

4.2.4 The operator shall, unless notice under this condition has been served within the preceding four years, submit to Natural Resources Wales, within six months of receipt of a written notice, a report assessing whether there are other appropriate measures that could be taken to prevent, or where that is not practicable, to minimise pollution.

4.3 Notifications

- 4.3.1 (a) In the event that the operation of the activities gives rise to an incident or accident which significantly affects or may significantly affect the environment, the operator must immediately—
- (i) inform Natural Resources Wales,
 - (ii) take the measures necessary to limit the environmental consequences of such an incident or accident, and
 - (iii) take the measures necessary to prevent further possible incidents or accidents;
- (b) in the event of a breach of any permit condition the operator must immediately—
- (i) inform Natural Resources Wales, and
 - (ii) take the measures necessary to ensure that compliance is restored within the shortest possible time;
- (c) in the event of a breach of permit condition which poses an immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment, the operator must immediately suspend the operation of the activities or the relevant part of it until compliance with the permit conditions has been restored.
- (d) of any malfunction or breakdown of abatement equipment relating to condition 2.3.7, the operator shall notify Natural Resources Wales within 48 hours unless notification has already been made under (a) to (c) above.

4.3.2 Any information provided under condition 4.3.1 (a)(i), or 4.3.1 (b)(i) where the information relates to the breach of a limit specified in the permit, shall be confirmed by sending the information listed in schedule 5 to this permit within the time period specified in that schedule.

4.3.3 Where Natural Resources Wales has requested in writing that it shall be notified when the operator is to undertake monitoring and/or spot sampling, the operator shall inform Natural Resources Wales when the relevant monitoring and/or spot sampling is to take place. The operator shall provide this information to Natural Resources Wales at least 14 days before the date the monitoring is to be undertaken.

4.3.4 Natural Resources Wales shall be notified within 14 days of the occurrence of the following matters, except where such disclosure is prohibited by Stock Exchange rules:

Where the operator is a registered company:

- (a) any change in the operator's trading name, registered name or registered office address; and
- (b) any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.

Where the operator is a corporate body other than a registered company:

- (a) any change in the operator's name or address; and
- (b) any steps taken with a view to the dissolution of the operator.

In any other case:

- (a) the death of any of the named operators (where the operator consists of more than one named individual);
- (b) any change in the operator's name(s) or address(s); and

- (c) any steps taken with a view to the operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case of them being in a partnership, dissolving the partnership.
- 4.3.5 Where the operator proposes to make a change in the nature or functioning, or an extension of the activities, which may have consequences for the environment and the change is not otherwise the subject of an application for approval under the Regulations or this permit:
 - (a) Natural Resources Wales shall be notified at least 14 days before making the change; and
 - (b) the notification shall contain a description of the proposed change in operation.
- 4.3.6 Natural Resources Wales shall be given at least 14 days' notice before implementation of any part of the site closure plan.
- 4.3.7 Where the operator has entered into a climate change agreement with the Government, Natural Resources Wales shall be notified within one month of:
 - (a) a decision by the Secretary of State not to re-certify the agreement;
 - (b) a decision by either the operator or the Secretary of State to terminate the agreement; and
 - (c) any subsequent decision by the Secretary of State to re-certify such an agreement.
- 4.3.8 The operator shall inform Natural Resources Wales in writing of the closure of any LCP within 28 days of the date of closure.

4.4 Interpretation

- 4.4.1 In this permit the expressions listed in schedule 6 shall have the meaning given in that schedule.
- 4.4.2 In this permit references to reports and notifications mean written reports and notifications, except where reference is made to notification being made "immediately", in which case it may be provided by telephone.

Schedule 1 - Operations

Table S1.1 activities

Activity Ref.	Activity listed in Schedule 1 of the EP Regulations	Description of specified activity	Limits of specified activity
A1	S1.1 A(1)(a) – Burning any fuel in an appliance with a thermal input of 50 megawatts.	Boiler plant	Refinery fuel oil storage and supply, boilers and abatement plant including: (i) 1 x 63.9 MW(th) boiler [designated B1] (ii) 2 x 63.8 MW(th) boilers [B2, B3] (iii) 1 x 78.9 MW(th) boiler [B4] (iv) 3 x 62.7 MW(th) boiler [B5, B6, B7] (v) 1 x 24.9 MW(th) boiler [B8] (vi) 1 x 74 MW MW(th) boiler [B9] (vii) 1 x 137 MW(th) natural gas fired cogeneration plant. From receipt of fuel to emissions of combustion products
A2	S1.2 A(1)(d) – Refining mineral oils	Refining mineral oil – primary operations	From feed to oil refining unit to use, intermediate or product storage, or export including each of the following units: (i) Vacuum distillation unit (typical throughput capacity – 640 m ³ /hr) and 2 x 47.5MW(th) heaters [H1, H2] (ii) Visbreaker unit (typical throughput capacity - 170 m ³ /hr) and 32.3MW(th) heater [H3] (iii) Fluidised catalytic cracker (typical throughput capacity - 625 m ³ /hr) and 318 MW (th) Regenerator [H5]. (iv) Kerosene Merox unit (typical throughput capacity - 223 m ³ /hr) (v) Hydro treater HTU-1 (typical throughput capacity - 275m ³ /hr) and 3 heaters (16.9MW(th) [H6], 14.2MW(th) [H7] and 6.5(th) [H8]) (vi) Hydro treater HTU-2 (typical throughput capacity - 220m ³ /hr) and 2 heaters (10.5MW(th) [H9] and 4.2MW(th) [H10]) (vii) Isomerisation unit (typical throughput capacity – 110m ³ /hr) (viii) LPG recovery unit (typical throughput capacity – 69,277 sm ³ /hr) (ix) Unifiner unit (typical throughput capacity - 340m ³ /hr) and 3 heaters (11MW(th) [H11], 9.6MW(th) [H12] and 7.3MW(th) [H13]) (x) Hydrogen recovery unit (typical throughput capacity - 18,645 sm ³ /hr) (xi) Platformer unit (typical throughput capacity - 255m ³ /hr) and 4 heaters (37.4MW(th) [H14], 30.4MW(th) [H15], 18.1MW(th) [H16] and 15.3MW(th) [H17]) (xii) FCC Merox unit (typical throughput capacity - 220m ³ /hr) (xiii) Alkylation unit (typical throughput 250m ³ /hr production of alkylate) and 2 heaters (28.8MW (th) [H18], and 22.1MW (th) [H19]. (xiv) Butamer unit (typical throughput capacity - 135m ³ /hr) and 1.75MW (th) heater [H20].

			(xv) Ultra-low sulphur gasoline (ULSG) unit (nominal throughput capacity – 328 m ³ /hr) and 33.4MW (th) heater [H24].
A3	S1.2 A(1)(d) – Refining mineral oils	Refining mineral oil – secondary operations – oil movements and blending	From receipt of feed, through blending (where necessary) to feed, intermediate and product storage including: liquefied petroleum gases, white oils, gas oils/ black oils, Crude oil/ slops. Road and ship loading and associated vapour recovery units.
A4	S1.2 A(1)(e) – The loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of – (i) Crude oil (ii) Stabilised crude petroleum	Handling and processing crude oil	From receipt of crude to operation of crude distillation unit including: (i) jetty operations (ii) Crude distillation unit (typical throughput capacity 13,360,300 m ³ /year) and 3 crude heaters (48.6MW(th) [H21], 52.7MW(th) [H22] and 58.5MW(th) [H23]) Crude storage (storage capacity – 538,625 m ³)
A5	S4.2 A(1)(a)(v) – Producing inorganic chemicals such as – non-metals, metal oxides, metal carbonyls, or other inorganic compounds.	Sulphur recovery and production	Removal of sulphur from aqueous waste stream by use of: (i) amine recovery unit (nominal throughput capacity – 185 m ³ /hr/train; 2 trains) (ii) FCCU sour water stripper (nominal throughput capacity – 32 m ³ /hr) (iii) CDU waste water stripper (nominal throughput capacity – 30 m ³ /hr) (iv) VDU waste water stripper (nominal throughput capacity – 55 m ³ /hr) (v) SRU 1 (nominal throughput capacity - 80 tonnes of sulphur/day). (vi) SRU 2 (nominal throughput capacity - 80 tonnes of sulphur/day). (vii) tail-gas incinerator (viii) Sulphur storage prior to export (storage capacity – 2pits of 1,400 tonnes each)
A6	S5.3 A1 (a)	Disposal of hazardous waste (other than by incineration or landfill) in a facility with a capacity of more than 10 tonnes per day.	From receipt of ballast water, through treatment (oil recovery operations) to disposal of treated water and solid waste.
A7	S5.4A(1)(a)(i)	Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day by biological treatment	Removal of oil and other chemicals from process water by action of aerobic/anaerobic bacteria within bio-cell.
A8	S5.4 A(1)(ii)	Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day by physico - chemical treatment.	From formation of waste water stream, discharge into site drainage systems to discharge of effluents to Milford Haven waterway including interceptors, DAF units and clarifiers.

A9	S1.2 Part B (a) – Blending odorant for use with natural gas or liquefied petroleum gas	Odourising LPG (or natural gas)	From feed to unit to discharge for storage or export
A10	S1.2 Part B (b) – The storage of petroleum in stationary storage tanks at a terminal, or the loading or unloading at a terminal of petrol or from road tankers, rail tankers or inland waterway vessels.	Loading petrol into road tankers	Loading of petrol into road tankers
Directly Associated Activities			
A11	Flaring of gases	Burning of sour and sweet gases at flares.	Hydrocarbon gas recovery compressor, flare headers, knock-out pots and flare stacks and any ancillary equipment.
A12	Cooling water systems	Systems used for cooling.	All cooling water systems including storage, pipelines and equipment, to discharge to ETP.
A13	Lagoons	The holding or temporary storage of water, effluents or oil-based liquids for settling (sedimentation) or other purposes	The feed point to the lagoon(s), the lagoon(s) and its drainage point.
A14	Oxygen or nitrogen generation	Air separation unit	Air separation plant to pipeline(s) delivering nitrogen to process plants
A15	Surface water drainage	Collection and handling of surface waters within installation	Handling and storage of site drainage until discharge to the site waste water treatment system or to discharge off-site.
A16	Water treatment	All water treatment activities	From receipt of raw materials to dispatch to effluents to sewer or site waste water treatment system.
A17	Storage of Hazardous Waste	R13: Storage of waste pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced)	The waste shall only be stored within designated area(s) agreed in advance in writing with Natural Resources Wales. This activity is only permitted for storage of liquid oil based hazardous wastes. All waste European Waste Classification Codes to be accepted at the site must be agreed in writing in advance. Any agreement is time limited for a period of 28 days, after which a new agreement must be sought if further waste is to be accepted.
A18	Demineralisation Plant	De-mineralising a small flow of softened and filtered water to allow on-line and off-line washing of the CTG and HRSG.	From receipt of softened and filtered water to the delivery at the CTG and HRSG. Neutralised regeneration fluid from the unit to the existing waste water drain line.

Table S1.2 Operating techniques

Description	Parts	Date Received
Application	PCC Application for Pembroke Refinery PPC Supplementary Technical Report: Volume 1 PCC Application for Pembroke Refinery PPC Supplementary Technical Report: Section 2.1 and 2.2 Controls: Volume 2 Application Site Report (Desk Study): Volume 3 of the PPC Application.	21/08/06
Response to Schedule 4 Notice dated 04/01/07	Response to questions 5, 12, 14, 16, 17, 18, 21, 22, 28 and 29.	15/06/07
Variation Application EPR/QP3033LW/V004	Document entitled "Technical proposal Natural Gas Pipeline" dated 23 November 2011	06/01/12
Variation Application EPR/YP3930EX/V002	Supporting documentation: Job Aid – PP-HES-JBA-0004	15/12/15
Response to Regulation 60 Notice	Document entitled "Review of Refinery operations against the" Refining of Mineral Oil and Gas" BAT Conclusions	27/05/16
Application	Permit Variation supporting information – Cogen/Permit/Supp/A01	09/05/17
Application	Noise and Vibration impact assessment – Cogen/DNS/Noise/A01	12/06/17
Application	Air Quality Impact Assessment – Cogen/DNS/AQIA/B01	21/06/17
Additional Information	Information received via Schedule 5 notice – noise assessment	08/08/17
Additional Information	Ethanol Delivery and Blending operations Document Ref: Road Tanker Ethanol Project 15/8/17	15/08/17
Variation Application EPR/YP3930EX/V007	Information submitted as part of the variation for a trial of used cooking oil. Part C2 and C3 of the application and all referenced supporting documents.	15/07/20

Table S1.3 Improvement programme requirements

Reference	Requirement	Date
IC33	<p>If residential property at 1 Pleasant View in Rhoscrowther is occupied at the start of operation, then following successful commissioning and establishment of routine steady operation, the operator shall undertake noise monitoring to confirm the conclusions of the application Noise and Vibration Impact Assessment report B01. This shall include:</p> <ul style="list-style-type: none"> • A full noise monitoring survey and assessment meeting BS4142:2014 standard • Narrow band (FFT) measurements to identify and any tonal elements or low frequency noise • Reference to the World Health Organisation guidelines for community noise and night noise <p>Upon completion of the work, a written report shall be submitted to Natural Resources Wales. The report shall refer to the predictions in the Noise and Vibration Impact Assessment report B01. If rating levels are expected to result in a significant impact in context at sensitive receptors, in an assessment in accordance with BS4142, then the report shall include an assessment of suitable abatement techniques, an estimate of the costs, the expected decibel reduction and a proposed timetable for their installation.</p>	Within 6 months of the completion of commissioning
IC34	The operator shall submit, for approval by Natural Resources Wales, a report setting out compliance with the appropriate BAT-AELs and Annex V of IED in relation to the cogeneration plant (A24).	Within 12 months of the completion of commissioning
IC35	<p>To reduce emissions to air from flaring, the Operator shall carry out and produce an Annual Flaring report to Natural Resources Wales that details the following:</p> <ul style="list-style-type: none"> • Minimum flare loading (baseload flaring) 	31 st January 2020

And for flaring events above an agreed threshold level (flaring event), it shall detail –

- Duration of each flaring event,
- Quantity and nature of material flared at each event, and
- Root cause(s) of each flaring event

The Annual Flaring report shall summarise the frequency of these flaring events and identify ways to reduce the frequency, magnitude and duration of flaring events, considering the techniques identified in BAT 55 and BAT 56 for the refining of mineral oil and gas. The findings of this work is the basis for an annual flare minimisation plan. Pre-notified flaring events do not need to have a root cause investigation. The Operator shall implement the minimisation plan to a timetable agreed with Natural Resources Wales

IC36	<p>A written procedure shall be submitted to Natural Resources Wales for approval detailing the methodology for monitoring Nitrogen Oxides to air utilising the refinery bubble principle as outlined in the Refinery BREF under:</p> <p>-</p> <p>BAT Conclusion 57.</p> <p>To achieve an overall reduction of NO_x emissions to air from combustion units (using Refinery Fuels), and fluid catalytic cracking (FCC) units, BAT is to use an integrated emission management technique as an alternative to applying BAT 24 and BAT 34.</p> <p>Where appropriate the procedure shall contain dates for the implementation of individual measures. The notification requirements of condition 2.5.2 shall be deemed to have been complied with on submission of the plan. The procedure shall be implemented by the operator from the date of approval by Natural Resources Wales.</p>	1 st October 2018
IC37	<p>A written procedure shall be submitted to Natural Resources Wales for approval detailing the methodology for monitoring Sulphur to air utilising the refinery bubble principle as outlined in the Refinery BREF under: -</p> <p>BAT Conclusion 58.</p> <p>To achieve an overall reduction of SO₂ emissions to air from combustion units (using Refinery Fuels), fluid catalytic cracking (FCC) units and waste gas sulphur recovery units, BAT is to use an integrated emission management technique as an alternative to applying BAT 26, BAT 36 and BAT 54.</p> <p>Where appropriate the procedure shall contain dates for the implementation of individual measures. The notification requirements of condition 2.5.2 shall be deemed to have been complied with on submission of the plan. The procedure shall be implemented by the operator from the date of approval by Natural Resources Wales.</p>	1 st October 2018
IC38	<p>The Operator shall submit for approval monitoring techniques and methods used for emissions monitoring to water compared with BAT Conclusion 10</p> <p>.</p> <p>A written report summarising the findings shall be submitted to Natural Resources Wales, along with a timetable for implementing improvements.</p>	1 st October 2018
IC39	<p>The operator shall submit, for approval by Natural Resources Wales, a report setting out progress to achieving the BAT 52 by the deadline of derogation.</p> <p>1. Associated targets / timelines for reaching compliance by December 2026.</p> <p>The first report due on the 1st December 2020, with a progress report every 2 yrs until completion.</p>	1 st December 2020

The report shall address the following BATc: 52		
IC40	<p>The Operator shall submit a report confirm the operating techniques and controls installed to minimise environmental impact on the Ethanol Delivery and Blending Operations.</p> <p>A written report summarising the findings shall be submitted to Natural Resources Wales, along with a timetable for implementing improvements.</p>	1 st October 2018
IC41	<p>The Operator shall submit a written report to Natural Resources Wales with the outcomes from the Used Cooking Oil (UCO) trial. The report shall include the following:</p> <ul style="list-style-type: none"> • The timescales when the trial was active. • Total Volume of waste material used. • Any process changes as part of the trial that could impact environmental parameters • Any modifications to the Operating Techniques/Onsite Emergency Plan • Any near misses/spills involving the UCO or disposal requirements • Overview of the of the environmental benefits of the trial. <p>A written report summarising the findings shall be submitted to Natural Resources Wales.</p>	2 months from completion of the trial

Table S1.4B Pre-operational measures for future development

Reference	Operation	Pre-operational measures
1	Cogeneration Plant	<p>If residential property 1 Pleasant View in Rhoscrowther is occupied, within 1 month of permit issue, the Operator shall submit to Natural Resources Wales for approval, a written proposal for enhancing the background sound measurements included in the original permit application.</p> <p>The background sound measurements ($L_{A90,T}$) and residual sound noise level (including tonality), shall be measured over a time period that is sufficiently long enough to obtain a typical background sound level which is representative of the area in which the installation is located. A typical background sound level shall be obtained for all times when the installation will be operational, in accordance with BS4142:2014 but also include diurnal patterns and seasonal variations.</p>
2	Cogeneration Plant	<p>If residential property 1 Pleasant View in Rhoscrowther is occupied, following Natural Resources Wales approval of the written proposal provided in response to PO1 and at least 1 month prior to the commencement of significant noise producing construction activities, the Operator shall measure the background sound level ($L_{A90,T}$) and residual noise level ($L_{Aeq,T}$) (including tonality), in order to obtain a representative background sound level. The results of this exercise shall be submitted in the form of a written report for approval to Natural Resources Wales.</p>

Schedule 2 - Waste types, raw materials and fuels

Table S2.1 Raw materials and fuels

Raw materials and fuel description	Specification
Crude oil	
Refinery fuel oil (RFO)	
Refinery fuel gas (RFG)	Less than 200 ppm sulphur (monthly average)
Refinery fuel (all fuels for LCP and other combustion plant)	Equivalent to 1% sulphur or less taking all fuels into account across all combustion plant
Natural Gas	Via Pipeline

Table S2.1(a) Permitted waste types and quantities to be imported to site for treatment within effluent plant.

Maximum Quantity	No limit set
Waste code	Description
16 07 08*	Ship ballast water containing oil/Wastes from ship transport tanks containing oil.

Table S2.1(b) Permitted waste types and quantities for Refinery Processing

Maximum Quantity	No limit set
Waste code	Description
20 01 25	Edible oils and fats

Schedule 3 – Emissions and monitoring

Table S3.1(a) Point source emissions to air								
Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A1/A2 (stack 1 – 91.5m above ground level) A3/A4 (stack 6 – 91.5m above ground level)	Sulphur dioxide	LCP371 and LCP373 boiler plant fired on 100% RFG	35 mg/Nm ³	38.5 mg/Nm ³	70 mg/Nm ³	35 mg/Nm ³ or bubble limits	See Note 1	BS EN 14181 (Continuous) BS EN 14791 (AST/QAL2)
A1/A2 and A3/A4	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP371 and LCP373 boiler plant fired on 100% RFG	300 mg/Nm ³	330 mg/Nm ³	600 mg/Nm ³	150 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A1/A2 and A3/A4	Dust	LCP371 and LCP373 boiler plant fired on 100% RFG	5 mg/Nm ³	5.5 mg/Nm ³	10 mg/Nm ³	5 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284- 1 (AST/QAL2)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A1/A2 and A3/A4	Carbon Monoxide (CO)	LCP371 and LCP373 boiler plant fired on 100% RFG	-	-	-	100 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 15058 (AST/QAL2)
A1/A2 and A3/A4	Sulphur dioxide	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	1000 [#] mg/Nm ³	1100 mg/Nm ³	2000 mg/Nm ³	600 mg/Nm ³ or bubble limits	See Note 1	BS EN 14181 (Continuous) BS EN 14791 (AST/QAL2)
A1/A2 and A3/A4	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	300-450* mg/Nm ³	330-495* mg/Nm ³	600-900* mg/Nm ³	300 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A1/A2 and A3/A4	Dust	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	(5-50*) mg/Nm ³	5.5-55* mg/Nm ³	10-100* mg/Nm ³	5-50* mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284- 1 (AST/QAL2)
A1/A2 and A3/A4	Carbon Monoxide (CO)	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	-	-	-	100 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 15058 (AST/QAL2)
A24	Oxides of Nitrogen (Note 8)	LCP652 Cogeneration Plan Stack	50 mg/Nm ³ (Note 2, 3 & 9)	50 mg/Nm ³ (Note 10)	100 mg/Nm ³ (Note 9)	50 mg/Nm ³ (Note 10) or bubble limit 35 mg/Nm ³ (Note 2, 3, 4 & 10)	- (Note 2, 3, & 4)	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A24	Carbon Monoxide (Note 8)	LCP652 Cogeneration Plan Stack	100 mg/Nm ³	110 mg/Nm ³	200 mg/Nm ³	100 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 15058 (AST/QAL2)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A7/A8/A9/ A10 (stack 8 – 158.5m above ground level) A7/A8 – crude distillation unit A9– vacuum distillation unit A10 - visbreaker unit	Sulphur dioxide	LCP375 (crude distillation unit) fired heaters on 100% RFG	35 mg/Nm ³	38.5 mg/Nm ³	70 mg/Nm ³	35 mg/Nm ³ or bubble limits apply see note 1	See Note 1	BS EN 14181 (Continuous) BS EN 14791 (AST/QAL2)
A7/A8/A9/A10	Sulphur dioxide	LCP375 (crude distillation unit) fired heaters on 0 – 100% RFO	1000 mg/Nm ³	1100 mg/Nm ³	2000 mg/Nm ³	600 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A7/A8/A9/A10	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP375 (crude distillation unit) fired heaters on 100% RFG	300 mg/Nm ³	330 mg/Nm ³	600 mg/Nm ³	150 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A7/A8/A9/A10	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP375 (crude distillation unit) fired heaters on 0 - 50% RFO	300 - 450 mg/Nm ³	330 - 495 mg/Nm ³	600 - 900 mg/Nm ³	300 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A7/A8/A9/A10	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP375 (crude distillation unit) fired heaters on 50 – 100% RFO	450 mg/Nm ³	495 mg/Nm ³	900 mg/Nm ³	450 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A7/A8/A9/A10	Dust	LCP375 fired heaters on 100% RFG	5 mg/Nm ³	5.5 mg/Nm ³	10 mg/Nm ³	5 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284- 1 (AST/QAL2)
A7/A8/A9/A10	Dust	LCP375 fired heaters on 0 - 100% RFO	5 - 50 mg/Nm ³	55 mg/Nm ³	100 mg/Nm ³	5 - 50 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284- 1 (AST/QAL2)
A7/A8/A9/A10	Carbon Monoxide (CO)	LCP375 fired heaters on 100% RFG	-	-	-	100 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 15058 (AST/QAL2)
A7/A8/A9/A10	Sulphur dioxide	LCP375 fired heaters on any VDU off gas in combination with RFG	1000 [#] mg/Nm ³	1100 mg/Nm ³	2000 mg/Nm ³	600 mg/Nm ³ or bubble limits	See Note 1	BS EN 14181 (Continuous) BS EN 14791 (AST/QAL2)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A7/A8/A9/A10	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP375 fired heaters on any VDU off gas in combination with RFG	300-450* mg/Nm ³	330-495* mg/Nm ³	600-900* mg/Nm ³	300 mg/Nm ³ or bubble limits	See Note 2	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A7/A8/A9/A10	Dust	LCP375 fired heaters on any VDU off gas in combination with RFG	5-50* mg/Nm ³	5.5-55* mg/Nm ³	10-100* mg/Nm ³	5-50* mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284- 1 (AST/QAL2)
A7/A8/A9/A10	Carbon Monoxide (CO)	LCP375 fired heaters on any VDU off gas in combination with RFG	-	-	-	100 mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 15058 (AST/QAL2)
A12 – platformer (stack 9 – 162m above ground level)	Sulphur dioxide	LCP372 fired heaters on 100% RFG	-	38.5 mg/Nm ³	-	35 mg/Nm ³ or bubble limits	See Note 1	Periodic BS EN 14791 (6 monthly)
A12	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP372 fired heaters on 100% RFG	-	330 mg/Nm ³	-	150 mg/Nm ³ or bubble limits	See Note 2	Periodic BS EN 14792 (6 monthly)

Table S3.1(a) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/Nm ³	ELV Daily mean mg/Nm ³	ELV 95 th ile of hourly means in a year mg/Nm ³	ELV IED monthly mean mg/Nm ³	ELV Bubble IED monthly mean mg/Nm ³	
A12	Dust	LCP372 fired heaters on 100% RFG	-	5.5 mg/Nm ³	-	5 mg/Nm ³	-	Periodic BS EN 13284- 1 (6 monthly)
A12	Carbon monoxide	LCP372 fired heaters on RFG	-	-	-	100 mg/Nm ³	-	Periodic BS EN 15058 (6 monthly)
A6 (stack 7 – 167.3m above ground level) (see A6A)	Sulphur dioxide	LCP374 heaters fired on 100% RFG	-	38.5 mg/Nm ³	-	35 mg/Nm ³ or bubble limits	See Note 1	Periodic BS EN 14791 (6 monthly)
A6	Oxides of nitrogen (NO and NO ₂ expressed as NO ₂)	LCP374 heaters fired on 100% RFG	-	330 mg/Nm ³	-	150 mg/Nm ³ or bubble limits	See Note 2	Periodic BS EN 14792 (6 monthly)
A6	Dust	LCP374 heaters fired on 100% RFG	-	5.5 mg/Nm ³	-	5 mg/Nm ³	-	Periodic BS EN 13284- 1 (6 monthly)
A6	Carbon monoxide	LCP374 heaters fired on 100% RFG	-	-	-	100 mg/Nm ³	-	Periodic BS EN 15058 (6 monthly)

Table S3.1(b) Point source emissions to air								
Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/m ³	ELV Daily mean mg/m ³	ELV 95 th ile of hourly means in a year mg/m ³	ELV IED monthly mean mg/m ³	ELV Bubble IED monthly mean mg/m ³	
A5A (stack 7 - 167.3 metres above ground level)	SO ₂	FCCU Catalyst Regenerator	-	-	-	600mg/Nm ³	See Note 1,7 & 12	BS EN 14181 (Continuous) BS EN 14791 (AST/QAL2)
A5A	NO _x	FCCU Catalyst Regenerator	-	-	-	700mg/Nm ³	See Note 2 & 7	BS EN 14181 (Continuous) BS EN 14792 (AST/QAL2)
A5A	Dust	FCCU Catalyst Regenerator	-	-	-	50mg/Nm ³	-	BS EN 14181 (Continuous) BS EN 13284-1 (AST/QAL2)
A6A (Stack 7 - 167.3 metres above ground level)	SO ₂	SRU	-	-	-	98.5% or equivalent rate in mg/m ³	See Note 1, 6 & 7	BS EN 14181 (Continuous) M22 (AST/QAL2)
A11 (Stack 9 - 162 metres above ground level)	Sulphur dioxide	Hydrotreater 1 and Unifiner	-	-	-	35mg/Nm ³	Note 1	BS EN 14791 (Annually) (Periodic)
A11	Oxides of nitrogen (as NO ₂)	Hydrotreater 1 and Unifiner	-	-	-	300mg/Nm ³	Note 2	BS EN 14792 (Annually) (Periodic)

Table S3.1(b) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/m ³	ELV Daily mean mg/m ³	ELV 95 th ile of hourly means in a year mg/m ³	ELV IED monthly mean mg/m ³	ELV Bubble IED monthly mean mg/m ³	
A11	Dust	Hydrotreater 1 and Unifiner	-	-	-	5mg/Nm ³	-	BS EN 13284-1 (Annually) (Periodic)
A11	Carbon monoxide	Hydrotreater 1 and Unifiner	-	-	-	-	-	BS EN 15058 (Annually) (Periodic)
A13 (Stack 9 - 162 metres above ground level)	Sulphur dioxide	Hydrotreater 2	-	-	-	35mg/Nm ³	Note 1	BS EN 14791 (Annually)
A13 (Stack 9 - 162 metres above ground level)	Oxides of nitrogen (as NO ₂)	Hydrotreater 2	-	-	-	300mg/Nm ³	Note 2	BS EN 14792 (Annually)
A13 (Stack 9 - 162 metres above ground level)	Carbon monoxide	Hydrotreater 2	-	-	-	-	-	BS EN 15058 (Annually)
A19 (Stack 10 - 70 metres above ground level) Gas only	Oxides of nitrogen (as NO ₂)	USLG	-	-	-	150mg/Nm ³ (or annual spot limit)	Note 2	BS EN 14792 (Annually)

Table S3.1(b) Point source emissions to air

Emission point ref. & location	Parameter	Source	A ⁵	B ⁵	C ⁵	D ⁵	E ⁵	Monitoring standard or method
			ELV EPR Monthly mean mg/m ³	ELV Daily mean mg/m ³	ELV 95 th ile of hourly means in a year mg/m ³	ELV IED monthly mean mg/m ³	ELV Bubble IED monthly mean mg/m ³	
A19 (Stack 10 - 70 metres above ground level) Gas only	Carbon monoxide	USLG	-	-	-	-	-	BS EN 15058 (Annually)

Notes

- * Emission limit values calculated in accordance with Article 40(2) of IED
- # As a residue is burnt then ELV applied in accordance with Article 40(3) of IED.
- 1 To apply bubble limits (column E and associated notes), the operator needs to have an approved SO₂ bubble management plan that meets BATc 58 (monitoring plan, flue gas flow rate measurement, a data management system and a template spread sheet to calculate the bubble ELV and compliance with the bubble ELV) and to use the ELVs for each release point in the bubble from column D.
- 2 To apply bubble limits (column E and associated notes), the operator needs to have an approved NO_x bubble management plan that meets BATc 57 (monitoring plan, flue gas flow rate measurement, a data management system and a template spread sheet to calculate the bubble ELV and compliance with the bubble ELV. and to use the ELVs for each release point in the bubble from column D
- 3 As GT ELVs are set to the standard dry gas 15% oxygen reference conditions, if this release point is to enter the bubble, then the ELVs and the CEMS data need to use standard dry gas 3% O₂ reference conditions rather than 15%.
- 4 If this release point is to be used the SO₂ (BATc 58) Bubble then the ELV that needs to be applied is 35 mg/m³ using the standard dry gas 3% O₂ reference conditions.
- 5 Application of limits for Annex V combustion plant - If a bubble limit is applied, compliance is against the limits in columns A, B & C with the bubble contribution from each Annex V combustion plant calculated using the elvs in Column D. If the SRU and/or the FCCU plants are in the bubble then the bubble contribution for these units is calculated using the relevant ELVs in Column D. If IED (BATAEL) limits apply (for combustion plant, SRU and FCCU plants) i.e. the bubble is not used, or that release point does not contribute to the bubble, then compliance is against the relevant limits in Columns B, C & D.
- 6 Release point A6A must have an equivalent concentration limit to the 98.5% efficiency limit for SRU when utilised within the SO₂ (BATc 58) Bubble.
- 7 Reference conditions for these releases are standard dry gas 3% O₂ reference conditions when applying the relevant bubble limits.
- 8 Limits apply at >70% Load.
- 9 For single cycle gas turbines having an efficiency greater than 35 % – determined at ISO base load conditions – the emission limit value for NO_x shall be $50\eta/35$ where η is the gas turbine efficiency at ISO base load conditions expressed as a percentage.
- 10 For single cycle gas turbines having an efficiency greater than 39 % – determined at ISO base load conditions – the emission limit value shall be $BAT-AEL\eta/39$ where η is the gas turbine efficiency at ISO base load conditions expressed as a percentage.
- 11 Limits apply when Dry Low NO_x system is operating.
- 12 When the sulphur in the total FCCU feedstocks are > 0.5% w/w sulphur as a monthly mean, then the BATAEL should be Increased to 800 mg/m³ as a monthly mean.

Table S3.1(c) Point source emissions to air						
Emission point ref. & location	Parameter	Source	Limit (including unit)	Reference Period	Monitoring frequency	Monitoring standard or method
A1, A2, A3, A4, A5A, A6, A7, A8, A9/A10, A11, A12, A13, A19, A24	Sulphur dioxide	Site operations	Bubble 1910mg/Nm ³	Hourly mean	Continuous	
A14 (CCR vent)	Hydrogen chloride	Continuous Catalytic Regenerator (Platformer)	-	-	6 Monthly	BS EN 1911
A14 (CCR vent)	Dioxins and Furans	Continuous Catalytic Regenerator (Platformer)			Annual	BS EN 13649
A15 (Acid flare)	-	Flares	No monitoring required during normal operation			
A16 (Sour flare)	-	Flares	No monitoring required during normal operation			
A17 (Sweet flare)	-	Flares	No monitoring required during normal operation			
A18 (Benzene VRU)	VOC, benzene	Benzene ship loading VRU			6 Monthly	BS EN 13649
A20 (Road loading VRU)	VOC	Road tanker loading VRU	0.15g/Nm ³		6 Monthly	BS EN 13649
Vents from oil storage tanks	VOC	Storage tanks				
Floating roof tanks	VOC	Storage tanks				
Process Relief valves	VOC, Sour gas	Refining process				
Sour flare, Sweet flare, Alky flare combined	SO ₂	Flares				

Table S3.2 Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Emission point ref. & location	Source	Parameter	Limit (incl. unit)	Reference Period	ELV Averaging Period	Monitoring frequency	Monitoring standard or method (or otherwise agreed in writing)
W1 discharge to Milford Haven waterway	Effluent Treatment Plant	Flow	25,000m ³ /day	Weekly average of daily flow	Daily	Daily	
		Temperature	35 °C	Daily average	Daily	Continuous	
		pH	6 – 9	24-hour proportional sample	Daily	Daily	ASTM D1293
		Oil	17 mg/l		Daily		Test Method 315
		Hydrocarbon Oil Index	2.5mg/l		Annual		EN 9377-2 (Note 1)
		Total Nitrogen (as N)	25 mg/l		Annual		ISO 11905-1
		Ammoniacal Nitrogen (as N)	20 mg/l		Daily		ISO 7150 - 1
		COD	270mg/l		Daily		ISO 6060 1989
			125mg/l		Annual		
		Phenols	3 mg/l		Daily		Test Method 345
		Phenol Index	No Limit		Annual	Monthly	EN ISO 14402:1999
		Suspended solids	85 mg/l	24-hour proportional sample	Daily	Weekly average of daily samples	ASTM D5907-09
			25mg/l		Annual		
		Sulphides	1 mg/l		Daily		ISO 10530 1991
		Fluoride	15 mg/l		Daily		Test method 320
		Cyanide	0.25 mg/l		Daily		ISO 6703-1-2-3 1984
		Iron	4 mg/l	7-day composite sample	Quarterly	Quarterly	BS EN ISO 11885
		Copper	0.080 mg/l		Quarterly		
		Zinc	0.56 mg/l		Quarterly		
		Nickel	0.085 mg/l		Annual		
		Vanadium	No limit set		Annual		
		Arsenic	No limit set		Quarterly		
		Chromium	No limit set		Quarterly		
		Lead	0.030 mg/l		Annual		

		Mercury and its compounds expressed as Mercury (Total Hg)	0.001 mg/l	Spot sample	Annual	BS EN 12846:2012
		Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	No Limit		Annual	
		Benzene	0.05mg/l		Annual	
		Cadmium and its compounds, expressed as cadmium (Total Cd)	0.008 mg/l		Annual	
W2 Pwllcrochan weir	Surface water run-off/failure of weir returning pumps	Oil	5 mg/l	Spot sample	3- hourly samples during emergency discharge	EN 9377-2
W3 West reservoir overflow.	Emergency discharge surface water lagoon	Oil	5mg/l	Spot sample	3-hourly samples during discharge	EN 9377-2

Note 1 – Moving to this method (EN 9377-2) may require an adaptation period.

Schedule 4 – Reporting

Table S4.1 (a) Reporting of monitoring data - LCP

Parameter	Emission or monitoring point/reference	Reporting period	Period begins
Oxides of nitrogen	A1, A2, A3, A4, A7, A8, A9, A10, A24	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Oxides of nitrogen	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Carbon monoxide	A1, A2, A3, A4, A7, A8, A9, A10, A24	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Carbon monoxide	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Sulphur dioxide	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Sulphur dioxide	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Dust	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Dust	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Invalid data	A1, A2, A3, A4, A7, A8, A9, A10, A24	Annual	1 January

Table S4.1 (b) Reporting of monitoring data – non-LCP

Parameter	Emission or monitoring point/reference	Reporting period	Period begins
Emissions to air (spot sample) – SO ₂ Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (hourly bubble) – SO ₂ Parameters as required by condition 3.6.1.	Combined emissions from Stack 1, Stack 6, Stack 7, Stack 8, Stack 9, Stack 10	Every 12 months	1 January,
Emissions to air (monthly bubble) – SO ₂	Combined emissions from Stack 1, Stack 6, Stack 7, Stack 8, Stack 9, Stack 10	Every 12 months	1 January
Emissions to air (monthly bubble) – NO _x	Combined emissions from Stack 1, Stack 6, Stack 7, Stack 8, Stack 9, Stack 10	Every 12 months	1 January,
Emissions to air (spot sample) - NO _x Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January

Table S4.1 (b) Reporting of monitoring data – non-LCP

Parameter	Emission or monitoring point/reference	Reporting period	Period begins
Emissions to air (spot sample) – Dust Parameters as required by condition 3.6.1.	A11	Every 12 months	1 January
Emissions to air (spot sample) – Dust, CO and metals (Ni, Sb, V) Parameters as required by condition 3.6.1.	A5A	Every 12 months	1 January
Emissions to air (spot sample) - CO Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (spot sample) – HCl Parameters as required by condition 3.6.1.	A14	Every 12 months	1 January
Emissions to air (spot sample) - VOC Parameters as required by condition 3.6.1.	A18, A20	Every 12 months	1 January
Emissions to air (spot sample) – dioxins and furans	A14	Every 12 months	1 January
Emissions to air – Site VOC	Site	Every 12 months	1 January
Emissions to air - Benzene	A18	Every 12 months	1 January
Emissions to water – flow, temperature Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water – pH and Oil Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water – suspended solids Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water – Ammoniacal Nitrogen (as N), COD and Phenols Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water – sulphide, fluoride, cyanide Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January

Table S4.1 (b) Reporting of monitoring data – non-LCP

Parameter	Emission or monitoring point/reference	Reporting period	Period begins
Emissions to water – iron, nickel, copper, zinc, vanadium, arsenic, chromium and lead. Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water - cadmium, mercury Parameters as required by condition 3.6.1	W1	Every 12 months for periodic monitoring	1 January
Emissions to water – Oil	W2	3 hourly samples	When Discharging
Emissions to water – Oil	W3	3 hourly samples	When Discharging
Emissions to water – Hydrocarbon Oil Index, Total Nitrogen [as N], Phenol index, COD, suspended solids, nickel, vanadium, lead, Mercury and its compounds expressed as Mercury [Total Hg], Benzene, Benzene, Toluene, Ethylbenzene, Xylene [BTEX], Cadmium and its compounds expressed as cadmium (Total Cd)	W1	Annual	1 January

Table S4.1 (c) Reporting of monitoring data – Chapter III Performance Parameters

Parameter	Frequency of assessment	Units
Thermal Capacity for each LCP	Annually	MW
Annual Fuel Usage for each LCP	Annually	TJ
Total Emissions to Air of oxides of nitrogen from each LCP	Annually	t
Total Emissions to Air of sulphur dioxide from each LCP	Annually	t
Total Emissions to Air of dust from each LCP	Annually	t
Operating Hours for each LCP	Annually	hours

Table S4.2 – Annual production/treatment

Parameter	Units
Road and other transport fuels	Tonnes
Non-transport/heating fuels	Tonnes
Chemical/petrochemical feedstock	Tonnes
Bitumen/pet coke/other heavy-end products	Tonnes

Table S4.3 – Performance parameters

Parameter	Frequency	Units
Crude oil and other oil import (i.e. feedstock)	Annually	Tonnes
Water usage	Annually	Tonnes/tonne feedstock
Energy usage (electrical)	Annually	MWh/tonne feedstock
Energy usage (all fuels)	Annually	MWh/tonne feedstock
Total effluent flow to water	Annually	m ³ /tonne feedstock
Total release of oil to water per tonne of feedstock	Annually	g oil/tonne feedstock
Annual emissions and fuel usage of LCP	Annually	Tonnes
Calculation of NO _x factors	Annually	Kg/Te fuel
Site Protection and Monitoring Programme Report	Annually	N/A

Table S4.4 Reporting forms

Media/ parameter	Reporting format	Starting Point	NRW recipient	Date of form
Air	LCP371/373/375/652 - concentrations	01/01/18	SI	01/01/16
Air	AR1	01/01/19	SI	01/01/16
Air	HR1	01/01/19	SI	01/01/16
Air	Air 1 Q2 & Q4	01/01/08	SI	01/01/16
Air	Air 3	01/01/12	SI	11/02/08
Air	Air 13	01/01/08	SI	11/02/08
Air	A5A monthly dust	01/01/19	SI	01/01/19
Air	SO2 bubble	01/01/19	SI	01/01/19
Air	NOx bubble	01/01/19	SI	01/01/19
Air	Air 15	01/01/19	SI	01/01/19
Air	Air 14 Q2 & Q4	01/01/08	SI	07/04/08
Air	Air 8	01/01/08	SI	11/02/08
Water	Water 1a	01/01/08	SI	02/04/08
Water	Water 2 W1	01/01/08	SI	02/04/08
Water	Water 2 W2	01/01/08	SI	02/04/08
Water	Water 2 W3	01/01/08	SI	02/04/08
Water	Water 3	01/01/08	SI	02/04/08
Water	Water annual	01/01/19	SI	01/01/19
Performance	Performance 1	01/01/08	SI	07/04/08
Energy	Energy 1	01/01/08	SI	18/03/08
Air	Air 10	01/01/08	SI	11/02/08
Air	Air 5	01/01/08	SI	11/02/08

Schedule 5 - Notification

These pages outline the information that the operator must provide.

Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

If any information is considered commercially confidential, it should be separated from non-confidential information, supplied on a separate sheet and accompanied by an application for commercial confidentiality under the provisions of the EP Regulations.

Part A

Permit Number	
Name of operator	
Location of Facility	
Time and date of the detection	

(a) Notification requirements for any activity that gives rise to an incident or accident which significantly affects or may significantly affect the environment	
To be notified immediately	
Date and time of the event	
Reference or description of the location of the event	
Description of where any release into the environment took place	
Substances(s) potentially released	
Best estimate of the quantity or rate of release of substances	
Measures taken, or intended to be taken, to stop any emission	
Description of the failure or accident.	

(b) Notification requirements for the breach of a permit condition	
To be notified immediately	
Emission point reference/ source	
Parameter(s)	
Limit	
Measured value and uncertainty	
Date and time of monitoring	
Measures taken, or intended to be taken, to stop the emission	

Time periods for notification following detection of a breach of a limit	
Parameter	Notification period

(c) In the event of a breach of permit condition which poses an immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment:	
To be notified immediately	
Description of where the effect on the environment was detected	
Substances(s) detected	
Concentrations of substances detected	
Date of monitoring/sampling	

Part B - to be submitted as soon as practicable

Any more accurate information on the matters for notification under Part A.	
Measures taken, or intended to be taken, to prevent a recurrence of the incident	
Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission	
The dates of any unauthorised emissions from the facility in the preceding 24 months.	

Name*	
Post	
Signature	
Date	

* authorised to sign on behalf of the operator

Part C - Malfunction or Breakdown of LCP abatement equipment

Permit Number	
Name of operator	
Location of Facility	
LCP Number	
Malfunction or breakdown	
Date of malfunction or breakdown	

(a) Notification requirements for any malfunction and breakdown of abatement equipment as defined by the Industrial Emission Directive*.	
To be notified within 48 hours of abatement equipment malfunction and breakdown	
Time at which malfunction or breakdown commenced	
Time at which malfunction or breakdown ceased	
Duration of the breakdown event in hours and minutes	
Reasons for malfunction or breakdown	
Where the abatement plant has failed, give the hourly average concentration of all measured pollutants.	
Cumulative breakdown operation in current year (at end of present event)	
Cumulative malfunction operation in current year (at end of present event)	
Name**	
Post	
Signature **	
Date	

* See section 3.6 and Appendix E of ESI Compliance Protocol for guidance

** authorised to sign on behalf of the operator

Schedule 6 - Interpretation

“accident” means an accident that may result in pollution.

“application” means the application for this permit, together with any additional information supplied by the operator as part of the application and any response to a notice served under Schedule 5 to the EP Regulations.

“authorised officer” means any person authorised by Natural Resources Wales under section 108(1) of The Environment Act 1995 to exercise, in accordance with the terms of any such authorisation, any power specified in section 108(4) of that Act.

“background concentration” means such concentration of that substance as is present in:

- for emissions to surface water, the surface water quality up-gradient of the site; or
- for emissions to sewer, the surface water quality up-gradient of the sewage treatment works discharge.

“calendar monthly mean” means the value across a calendar month of all validated hourly means.

“CCR” means Continuous Catalytic Regenerator

“Combustion Technical Guidance Note” means IPPC Sector Guidance Note Combustion Activities, version 2.03 dated 27th July 2005 published by Environment Agency.

“disposal”. Means any of the operations provided for in Annex I to Directive 2008/98/EC of the European Parliament and of the Council on waste.

“dynamic emission limit value” (DELV) means an emission limit that varies in accordance with Article 40 of the Industrial Emissions Directive.

“ELV” means Emission Level Value

“emissions to land” includes emissions to groundwater.

“energy efficiency” the ISO base load net plant efficiency means the performance value established by acceptance testing following improvements made to the plant that could affect the efficiency.

“FCCU” means Fluid catalytic cracking unit.

“GT” means Gas Turbine

“Industrial Emissions Directive” means DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions

“EP Regulations” means The Environmental Permitting (England and Wales) Regulations SI **2016 No.1154** and words and expressions used in this permit which are also used in the Regulations have the same meanings as in those Regulations.

“groundwater” means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

“large combustion plant” or *“LCP”* is a combustion plant or group of combustion plants discharging waste gases through a common windshaft or stack, where the total thermal input is 50 MW or more, based on net calorific value. The calculation of thermal input, excludes individual combustion plants with a rated thermal input below 15MW.

“MCERTS” means the Environment Agency’s Monitoring Certification Scheme.

“mcr” means maximum continuous rating.

“Natural gas” means naturally occurring methane with no more than 20% by volume of inert or other constituents.

"operational hours" are whole hours commencing from the first unit ending start up and ending when the last unit commences shut down.

"quarter" means a calendar year quarter commencing on 1 January, 1 April, 1 July or 1 October

"recovery" means any of the operations provided for in Annex II to Directive 2008/98/EC of the European Parliament and of the Council on waste.

"RFG" means Refinery Fuel Gas

"RFO" means Refinery Fuel Oil

"SI" means site inspector

"SRU" Sulphur Recovery Unit

"VDU" means Vacuum Distillation Unit

"Waste code" means the six-digit code referable to a type of waste in accordance with the List of Wastes (England) Regulations 2005, or List of Wastes (Wales) Regulations 2005, as appropriate, and in relation to hazardous waste, includes the asterisk.

"Waste Framework Directive" or "WFD" means Waste Framework Directive 2008/98/EC of the European Parliament and of the Council on waste.

"year" means calendar year ending 31 December.

Where a minimum limit is set for any emission parameter, for example pH, reference to exceeding the limit shall mean that the parameter shall not be less than that limit.

Unless otherwise stated, any references in this permit to concentrations of substances in emissions into air means:

1. in relation to emissions from combustion processes, the concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 3% dry for liquid and gaseous fuels, 6% dry for solid fuels, 3% dry for FCCU Regenerator and 3% O₂ for the Waste gas sulphur recovery Unit when BAT58 (SO₂ bubble) is applied.
2. in relation to emissions from non-combustion sources, the concentration at a temperature of 273K and at a pressure of 101.3 kPa, with correction for water vapour content.
3. *"assessment year"* means any complete calendar year except that the first assessment year for the purposes of this permit shall run from 1 October 2006 until 31st December 2007
4. *"CEN"* means Comité Européen de Normalisation
5. *"central office"* means an address for reporting forms for the attention of Natural Resources Wales head office staff, which has been separately notified to the operator.
6. *"combustion technical guidance note"* means IPPC Sector Guidance Note Combustion Activities, version 2.03 dated 27th July 2005 published by The Environment Agency.
7. *"operational hours"* of an LCP is the time spent between start up and shut down of the LCP.

Schedule 7 – Site Plan



END OF PERMIT

Annex to conditions – Derogation under Industrial Emissions Directive

Derogation under Article 15(4) of Industrial Emissions Directive

DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions

Operating techniques	<p>We have considered the Operator's proposed techniques and its comparison against other relevant techniques as described in the relevant BAT reference note. Our full reasoning is given in our decision document that accompanies the permit determination.</p> <p>The proposed techniques will result in emissions for which the appropriate emission limits are less stringent than those associated with the best available techniques as described in BAT conclusions.</p> <p>We have considered the operator's justification for departure from the guidance and accept it in the following respects and for the following reasons;</p> <p>The achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:</p> <p>Pembroke's berth infrastructure is more than 2km long. Berths 7 & 8 (berths 2, 7 & 8 currently exceed the 1 million m3 per annum of products loaded with an RVP above 4kPa are the furthest from the refinery foreshore. Berths 7 & 8 were designed to handle most domestic gasoline exports, and alternate berth occupancy levels prevents simply moving the gasoline exports to closer berths.</p> <p>Around 90% of gasoline made in the refinery is moved across the jetty, rather than by road or pipeline transmission; and the refinery has no connections to the rail network. Thus, making the implementation of the BAT 52 operationally challenging.</p> <p>Pembroke refinery manufactures multiple gasoline products (over thirty different grades since 2012) for the UK, European and International markets. Using vapour recovery before rationalising the use of the jetty berths can result in product contamination. Large export volume, low RVP (Reid Vapour Pressure) gasoline products are most at risk of being off-specification (due to high RVP content) caused by absorption of high RVP UK and European grade vapours. Each compartment is tested independently and any high in RVP will be in breach of the product specification, even if the whole ships aggregate quality is acceptable. This is important as vapour recovery techniques absorb the VOC's which are then returned into the gasoline blend that is being loaded. So, as a one smaller cargo of high RVP export is completed those peak VOC's will typically be absorbed and returned into a different ship's compartment of the other (larger) export, the addition of these high RVP fractions increase the potential to be off-specification. Counteracting this by continually swapping absorbent to each smaller, higher RVP, co-current export will add significantly to the business cost with shipping delays. This results in the need for multiple VRU's and a high business cost.</p> <p>No significant pollution will be caused; the VOC release is currently limited as much as possible to ensure product specification is maintained by keeping the ships hold as enclosed as possible shortening the time for equilibrium to be reached. There are no indications that the release of VOC</p>
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in the locality is causing an environmental impact. The area now has one oil refinery where once there was 4, this has resulted in an overall reduction in the emissions from this sector.

NMVOC does have a role in ground level ozone production but due to the refineries location it is not having an effect locally. There is a monitoring station at Narberth for NMVOC and Ozone the air quality at this site is good and considered a background site.

The achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to the technical characteristics of the installation concerned.

The emissions from the site are reducing due to the tightening of emission limits and the current standards will be maintained in the interim then a high level of protection is achieved. Valero have committed to installing vapour recovery by 2026.

NRW are satisfied that there are disproportionally higher costs compared to the environmental benefits.

The derogation request for BAT 52 is approved on the grounds that it meets the criteria for derogation as stated in Article 15(4) of the Directive.

Parameter	BAT-AEL (hourly average) (1)	Derogation Until
NMVOC	0.15-10 g/Nm ³ (2) (3)	December 2026
Benzene(3)	< 1 mg/Nm ³	December 2026

(1) Hourly values in continuous operation expressed and measured according to European Parliament and Council Directive 94/63/EC (OJ L 365, 31.12.1994, p. 24).

(2) Lower value achievable with two-stage hybrid systems. Upper value achievable with single-stage adsorption or membrane system.

(3) Benzene monitoring may not be necessary where emissions of NMVOC are at the lower end of the range.

